



CENTRE DE RECERCA MATEMÀTICA

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## Nonlinear Dynamics and Catastrophic Extinctions in Unstable Tumor Cells Populations

### Abstract:

The inherent nonlinear behaviour of biological systems often involves the emergence of interesting dynamical phenomena. Also, different types of transitions (bifurcations) can cause important changes in the qualitative dynamics of these systems, sometimes involving clearance of pathogens or fading of tumor cells populations.

In this seminar we will analyse a nonlinear differential equations model describing the dynamics of a heterogeneous population of tumor cells competing with healthy cells. By means of Eigen's quasispecies model, we will show the presence of an abrupt transition separating two phases given by tumor persistence and tumor extinction. The transition between these two phases is governed by a novel type of bifurcation that we have named as trans-heteroclinic bifurcation. Such a bifurcation involves the stability exchange between two distant fixed points that have an heteroclinic connection and that remain confined at the sides of an eight-dimensional simplex. This stability exchange, together with the no collision of the two equilibria, involves a discontinuous transition.

We will comment on the possible novelty of this type of bifurcation in continuous flows. Finally, we will discuss the implications of our mathematical results within the framework of the so-called targeted cancer therapies and potential tumors' clearance.

**Date:** February 21, 2017

**Place:** Room C1/028

**Time:** 12:00

